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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/808,193	03/24/2004	Kenichi Koyanagi	NECN 21.087	4587

26304 7590 10/23/2006
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EXAMINER

EVERHART, CARIDAD

ART UNIT	PAPER NUMBER
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2891

DATE MAILED: 10/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/808,193	Applicant(s) KOYANAGI ET AL.	
	Examiner Caridad M. Everhart	Art Unit 2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 August 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Response to Arguments

Applicant has argued that Basceri's method addresses the need to "improve adherence". This argument is respectfully found to be not persuasive because the reference may have a different rationale for a method than that of applicant(MPEP 2144). Applicant has further argued that Basceri discloses a three-layered structure. This argument is respectfully found to be not persuasive because the claims recite comprising language and in addition the first layer is a monatomic film which includes metal and the layer which is deposited on that layer is a metal oxide film, even though it can include metal atoms with the metal oxide molecules, as in this case the oxide is a metal oxide which is not stoichiometric. A transitional layer would be expected on a molecular level at the interface because of diffusion effects. The method of Basceri includes the method of forming such a transitional layer by deposition. Applicant has further argued that Basceri discloses ALD rather than CVD. This argument is respectfully found to be not persuasive for the following reasons. Basceri discloses that the method taught by Basceri is applicable to CVD as well as to ALD(col. 2, lines 52-57), and a patent is relevant as prior art for all that it contains(MPEP 2123). Therefore, although Basceri teaches ALD, and the examples are of ALD, the method can also be carried out for CVD according to the disclosure. The ALD provides improvement from carrying out the process with CVD(col. 1, lines 21-23), but can be carried out with CVD. As support for that in the art ALD and CVD are used in the alternative in the art, George et al (US 200500112975) is cited as paragraph 0064 discloses that ALD is self-limiting

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and multiple cycles apply a layer of desired thickness, each cycle depositing a monolayer. Solanki et al (US 20040200414) discloses in paragraph 0007 that ALD offers highly conformal films and that the same chemistry can be used for CVD. Werkhoven, et al (US 20030129826) discloses in paragraph 0036 that ALD can be conducted at lower temperatures than CVD, and that multiple cycles are used to deposit layers of the desired thickness. Basceri, as cited above, discloses that the method taught by Basceri can be used for both ALD and CVD. Applicant has further argued that applicant's method does not involve intermixing in the step of forming the monoatomic seed layer. This argument is respectfully found to be not persuasive because in the method taught by Basceri, in the step of forming the metal oxide layer may include formation of a Ta₂O₅ layer by formation of a Ta monolayer using TaCl₅(col. 7, lines 38-40) and the oxidation of that monolayer by using an oxidant such as O₂(col. 7, lines 24-30), which would constitute the step of forming a monoatomic seed layer on a base. The metal precursor is pulsed to form the metal layer, then the oxidizing agent is pulsed in order to oxidize the metal layer(col. 7, lines 30-37).

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 102

Claims 1, 6,7, 12, 13, 14-21 are rejected under 35 U.S.C. 102(e) as being anticipated by Basceri, et al. (US 6,908,639B2).

Basceri, et al disclose the steps of forming a monolayer of metal such as Ta(col. 3, lines 3-8 and col. 1, lines 35-39). The monolayers are of the same species(col. 3, lines 14-18). Then a second layer of tantalum oxide is deposited(col. 4, lines 40-49) The method of depositing the oxide may be CVD(col. 3, lines 63-67). Basceri, et al disclose the forming of a capacitor(col. 4, lines 50-60 and col. 5, lines 47-64). This would include forming bottom electrode, high k dielectric, and top electrode. The precursor for tantalum is either TaCl₅, TaF₅, or TATDMAE(col. 7, lines 37-40). The substrate is a semiconductor wafer, which would include silicon wafer(col. 2, lines 60-67).

Claim Rejections - 35 USC § 103

Claims 2,3, 4, 7, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Derderian, et al (US 6,458,416B1).

Basceri et al teaches Ti can be one of the deposited metals(claims 25, 34, and 37), but is silent with respect to the recited precursors.

Basceri, et al is silent with respect to the initiation of the precursor.

Derderian et al disclose forming an initiation precursor layer before the deposition of the precursor in atomic layer deposition(col. 3, lines 29-35). The initiator may be water(col. 6, lines 10-15). The temperature is at raised temperature, so that the water is a heated vapor(col. 6, lines 20-25). Derderian teaches TMA (Al(CH₃)₃) as a precursor(col. 5, lines 40-45).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have combined the steps taught by Derderian et al with the steps taught by

Basceri et al in order to form the better sticking of the layer taught by Derderian et al and without defects as taught by Derderian et al (col. 1, lines 14-16). Derderian et al teach that TMA is a known precursor for ALD and therefore would have been obvious to choose TMA for one of ordinary skill in the art. It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the recited precursors because Basceri et al teaches the precursors for Ta, and the same ligands for the Ti would have been obvious to one of ordinary skill in the art.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Basceri et al in view of Derderian et al as applied to claims 1 and 2 above, and further in view of Dean, et al(US 2005/0009335A1).

Basceri et al in view of Derderian et al is silent with respect to HF treatment.

Dean et al discloses the HF treatment of a silicon substrate prior to ALD (paragraph 0065).

It would have been obvious to one of ordinary skill in the art to have used HF as taught by Dean et al in the process taught by Basceri et al in view of Derderian et al because Basceri et al in view of Derderian et al teach a treatment in order to terminate the substrate, and the use of HF as taught by Dean et al would result in an H-terminated silicon substrate.

Claims 10 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Basceri et al in view of Derderian et al as applied to claims 1 and 2 above, and further in view of Elers (US 6,767,582).

Basceri et al in view of Derderian et al is silent with respect to the recited compounds.

Elers discloses the use of NbCl₅ in ALD(col. 9, lines 23-50).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the material taught by Elers in the process taught by Basceri et al in view of Derderian et al because NbCl₅ is taught by Elers because the compounds are known in the ALD art.

Claims 9 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Basceri, et al in view of Derderian et al as applied to claims 1 and 2 above, and further in view of Metzner, et al (US 6,858,547).

Basceri et al in view Derderian et al is silent with respect to the recited compounds.

Metzner et al discloses hafnium amido alkyl precursors for ALD(claim 14).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the compounds taught by Metzner et al in the process taught by Basceri et al in view of Derderian et al because Metzner et al teaches the compounds for ALD.

The prior art of record not relied upon is considered relevant to applicant's disclosure. Lee (US 2006/022888A1). Lee discloses Hf-TDMA precursor for ALD hafnium oxide(paragraph 0007).

Raaijmakers et al (US 2001/0024387A1). Raaijmakers et al discloses NbCl₅ for ALD niobium oxide(paragraph 0075 and 0077).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caridad M. Everhart whose telephone number is 571-272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, B. Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

C. Everhart
10-17-2006

C. Everhart
CARIDAD EVERHART
PRIMARY EXAMINER